CEMENT
AND
CEMENT MANUFACTURE
INCORPORATING "PORTLAND CEMENT"

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Cement—A Chemical Manufacture.

ONLY of late years can the claim be justified that the Portland cement industry has raised itself to the status of a chemical manufacture. It is true there is no recognised definition of a chemical manufacture, but the technical literature of cement and a knowledge of modern cement works make it impossible to dispute the inclusion of Portland cement in that category. No longer can it be said that cement is made by calcining and grinding a mixture of raw materials containing about 76 per cent. of carbonate of lime. The cement made in such a way could not maintain a position in the forefront of the modern market that is so keenly competitive in regard to quality. The constituents of cement that were formerly thought to be of minor importance have now to receive attention, and, where necessary, silica, alumina or iron oxide must be imported in the same way that gypsum has been brought to cement factories. The degree of contamination with coal ash must also be taken into account, and adjustments made to the raw material mixture to compensate for variations in the percentage and composition of the ash in the coal. The stage is imminent when cement will be judged by the proportions of the silicates and aluminates of lime it contains, although at the outset such proportions will be calculated and not revealed by direct determination.

These changes imply that in a cement factory which aims at remaining in the forefront in the race for quality supremacy the chemist's part is becoming of great importance, and with the development of the chemist there will follow a tendency to greater accuracy. Irregularities and inaccuracies are as abhorrent to the chemist in the factory as in the laboratory; even more so, because the chemist realises more than anyone that the efficiency of the crucial process in cement manufacture, viz. calcination, is severely handicapped because of its restriction to "clinkering" and its inability to pass on to fusion. The stage of fluidity which would be of immense advantage in producing the perfect amalgamation and consistency that lead to maximum yield of the desired chemical compounds is not reached in the kiln, and it is therefore necessary that the interaction of particles of lime and argillaceous matter should be facilitated by fine grinding and intimate mixing. To attempt to make a cement containing definite proportions of the known silicates and aluminates of lime from slurry having a residue on a 50-mesh sieve seems as unreasonable to chemists as using

tap-water for chemical analysis. Similarly, if 77 per cent. of carbonate of lime is needed in a raw material mixture to produce the required cementitious compounds, it is folly to permit a mixture containing 77.2 per cent. carbonate of lime to be used, especially when air-agitation of slurry can be applied to effect consistency of composition. The ideals of the chemists are accuracy and consistency, and the means of obtaining these are mixing at every stage of the manufacture—not only slurry mixing, but clinker mixing, cement mixing, and even coal mixing. In due time, also, the physicist will be needed to investigate the problems connected with the degree of calcination and the size of particle in the finished cement.

Cement Production in the United States.

THE total United States' production of Portland cement for the nine months ended September 30 1929 shows a decline of about 3,000,000 barrels, as compared with the corresponding period of 1928, according to a statement published by the Bureau of Mines, U.S. Department of Commerce. The production during the first nine months of 1929 was 128,165,000 barrels, while the output for the first nine months of last year was 131,178,000. For September 1929 compared with September 1928 the output showed a decrease of 3.7 per cent., and sales a decrease of 2.5 per cent., compared with September 1928. Portland cement stocks at the mills were 3.2 per cent. higher than a year ago. The total production for the nine months ending September 30 1929 amounted to 128,165,000 barrels, compared with 131,178,000 barrels in the same period of 1928. The total sales for the nine months ending September 30 1929 amounted to 133,545,000 barrels, compared with 136,284,000 barrels in the same period of 1928.

The output of two new plants in Arkansas and Western Pennsylvania is included in these statistics, which are compiled from reports for September from all manufacturing plants except two, for which estimates have been included in lieu of actual returns.

New Russian Cement Plant.

WORK is to start early in 1930 on the erection of the new cement plant at Suchoilog, for which the machinery is being supplied by Mühlenbau und Industrie Aktiengesellschaft, of Braunschweig. The factory belongs to the Uralstrom-Trust Swerdlowsk, and will have an output of 390 tons a day. Limestone and clay are found in the neighbourhood. "Titan" crushers are to be used for crushing the limestone, which is mixed with clay in a combination mill. From the mills the mixture is pumped by centrifugal pumps to the storage tanks. Two rotary kilns, 2.8 metres by 65 metres, are to be installed, with enlarged burning zones and coolers.

The Heat Balance in Rotary Kilns.

By A. C. DAVIS, M.I.Mech.E., M.Inst.C.E.I., F.C.S.

(Works Managing Director, Associated Portland Cement Manufacturers, Ltd.)

THE problem of the efficient utilisation of heat when clinkering raw material in a rotary kiln is somewhat similar to that of the conversion of heat into steam in a boiler. Investigation into the amount of heat dissipated and wasted in cement kilns necessarily follows somewhat the procedure adopted in investigating the efficiency of steam boilers. The total heat given out by the coal used in making one ton of cement clinker is ascertained and compared with the heat which is theoretically necessary.

In the compilation of balance sheets showing the heat distribution in rotary kilns, the earlier chapter on the reactions in burning cement will have made it clear that there is still some uncertainty regarding details of the burning operation, but this is not sufficient to detract seriously from the value of a close study of heat balances.

The various operations in which heat is usefully expended, recovered, or wasted, may be summarised as follows:—

(*a*) Heat is usefully expended in—
- (1) Drying the raw materials.
- (2) Decomposing the calcium carbonate.
- (3) Heating the raw materials to clinkering temperature.

(*b*) Heat is recovered from—
- (4) The cooling of the hot clinker.
- (5) The combination of lime and clay at the clinkering temperature.

(*c*) Heat is lost in—
- (6) Radiation from the kiln and cooler shells.
- (7) The waste gases leaving the kiln.
- (8) Imperfectly cooled clinker leaving the cooler.
- (9) Heating air in excess of that needed for combustion.
- (10) Imperfect combustion.

There is little difficulty in calculating the heat required to evaporate the moisture from the raw materials, and to superheat to the temperature of the exit gases the steam formed.

It would be difficult to calculate directly the heat expended in raising the raw materials to clinkering temperature, as the specific heats of the raw materials when approaching the clinkering temperature are not definitely known, but this is not necessary. The heat expended in bringing the raw materials to clinkering point will be, under suitable conditions, largely recovered in the clinker cooler. The coal burned for the purpose of heating up the raw materials will only be that required to make good losses due to defective cooling, such as imperfectly cooled clinker, cooler radiation, etc.

The heat required to decompose the calcium carbonate and the heat evolved by the union of lime and clay at the clinkering temperature was discussed at length in the previous chapter.

Accurate determination of the heat lost by radiation from kiln and cooler shells is difficult, owing to variation in the shell surface due to presence of paints and rust. The temperature also varies considerably due to differences in the thickness of the firebrick lining and the internal temperature. Heat is also lost from these parts by convection air currents. This is a very variable quantity, depending largely on whether the shell is protected from the wind and weather.

The total of these fuel losses is probably of the order of 3 per cent. of clinker production, so that the variations indicated will not result in very wide error in making calculations.

The calculation of the heat lost in the waste gases presents little difficulty, provided the position chosen for the pyrometer is such that it gives the correct average temperature of the gases. A doubtful point is the specific heat of the gases at the higher temperatures, such as 900 deg. F., which are sometimes reached. Many valuable experiments on specific heats of gases have, however, been conducted, and the point becomes of lesser importance as modern methods of kiln operation and heat utilisation reduce the temperature of the waste gases.

It will be seen, therefore, that the total heat or quantity of coal required to produce one ton of clinker is capable of calculation, and very close agreement can be obtained in this matter with the coal consumption observed in actual practice extending over a long period.

For the purpose of preparing a rotary kiln heat balance, the following data is required:—

Analysis of the coal used.
Per cent. $CaCO_3$ in dry raw material.
Per cent. moisture in dry raw material.
Per cent. moisture in coal.
*Standard coal to clinker, per cent.
*Standard coal factor $\frac{\text{calories as received}}{7{,}000}$
Exit gas temperature.
Clinker temperature ex cooler.
Exit gas analysis CO_2 per cent.
CO per cent.
O_2 per cent.
Organic matter in dry raw material, per cent.

*Standard coal is assumed to be a coal having calorific value of 7,000 calories (12,600 B.T.U.'s per lb.).

The method of calculating the amount of heat passing out, in and from, various directions and sources is best explained by taking a typical case and working it out in detail. For convenience the data required in the examples which follow is set out below.

Data Required.	Heat Balance.	
Per cent. $CaCO_3$ in raw material	76.5	
Per cent. moisture in raw material	40.0	
Per cent. moisture in coal	10.0	
Standard coal to clinker, per cent.	27.0	
Standard coal factor $=\frac{\text{calories as received}}{7{,}000}$ ...	0.85	
Exit gas temperature	700	deg. Fahr.
Clinker temperature *ex* cooler	300	,,
Preheated air temperature	600	,,
Exit gas analysis CO_2 per cent.	25.7	
CO ,, ...	0.2	
O_2 ,, ...	1.5	
Organic matter in dry raw material, per cent. ...	1.0	

It may be noted that in practice it will be found convenient to prepare tables for readily making the calculations. Useful tables are as follows:

(1) CO_2 in exit gases per 100 lbs. of clinker for varying percentages of $CaCO_3$.
(2) B.Th.U. per lb. of CO_2 at different exit gas temperatures.
(3) B.Th.U. per lb. of water at different exit gas temperatures.
(4) B.Th.U. per lb. of air at varying exit temperatures.
(5) Weight of water per 100 lbs. clinker for varying slurries.
(6) B.Th.U. required for dissociation of carbonates per 100 lbs. clinker.
(7) Weight of gases from combustion of 1 lb. of coal at different exit gas temperatures.
(8) Weight of excess air per 100 lbs. clinker for varying standard coal consumption and CO_2+CO in exit gases.
(9) B.Th.U. per lb. of clinker for varying standard coal consumption and CO_2+CO in exit gases.
(10) B.Th.U. in clinker leaving cooler at varying temperatures.

(1) **Heat Contained in CO_2 from Raw Materials at Exit Temperatures.**—The weight (lbs.) of CO_2 per 100 lbs of clinker will vary with the carbonate content of the slurry, and the heat (B.Th.U.) in each pound of this gas varies with the back-end temperature.

EXAMPLE.—

CO_2 at kiln exit temperature of 700 deg. F. =145 B.Th.U. per lb.
Weight when slurry carbonate is 76.5 per cent. =57.7 lbs.
Therefore 57.7 x 145=8,366 B.Th.U. in CO_2 from slurry carbonate ... (1)

(2) **Heat Carried Away by Slurry Water.**—The weight of water from the slurry, including that from 1 per cent. of organic matter for each 100 lbs. clinker, is determined, allowing for variations in both slurry moisture and $CaCO_3$. The heat units per pound of water will vary with the temperature of the exit gases.

EXAMPLE.—

Slurry moisture 40 per cent. Carbonate 76.5 per cent. =107.1 lbs. water.
Exit temperature 700 deg. F. =1,351 heat units per lb. water.
107.1 x 1,351 =144,692 B.Th.U. per 100 lbs. clinker .... (2)

(3) **Heat Required for Dissociation of Carbonates.**—A table can be prepared to give this figure as a direct reading according to the percentage of $CaCO_3$.

EXAMPLE.—

Carbonate in slurry 76.5 per cent. =91,120 B.Th.U. per
100 lbs. clinker .... (3)

(4) **Heat in Combustion Gases at Exit Temperature.**—The average B.Th.U. in gases at the exit temperature from the combustion of one pound of coal, when multiplied by the percentage of standard coal burned, will give the heat loss from this source.

EXAMPLE.—

Exit temperature 700 deg. F. standard coal used 27 per cent.
B.Th.U. in gases per lb. of coal at 700 deg. F. =2,143.
2,143 x 27 =57,861 B.Th.U. per 100 lbs. clinker .... (4)

(5) **Heat in Excess Air at Exit Temperature.**—Determine the weight of excess air according to the known standard coal consumption and the known CO_2+CO in exit gas. Multiply this by the percentage of oxygen in exit gas. Having found the weight of excess air per 100 lbs. of clinker from the table, find the B.Th.U. per lb. at exit gas temperature and multiply by lbs. excess air per 100 lbs. clinker.

EXAMPLE.—

$CO_2=25.7$ per cent. $CO=0.2$ per cent. $CO+CO_2=25.9$ per cent.
Standard coal ... ... 27 per cent.
Weight of excess air = 15.9 lbs. Oxygen = 1.5 per cent.
$\therefore$ 15.9×1.5 $O_2 = 23.85$ lbs. excess air per 100 lbs. clinker.
Exit gas temperature ... ... 700 deg. F.
B.Th.U. per lb. of air at 700 deg. F. $= 150 \times 23.85$ lbs.
= 3,580 B.Th.U. per 100 lbs. clinker ....(5)

(6) **Heat in Water in Coal Moisture.**—Weight of water per 100 lbs. clinker = moisture in coal as received, divided by the standard coal factor

$$\frac{\text{calories as received}}{7{,}000}$$

and multipled by the standard coal consumption. Multiply this by the B.Th.U's per lb. of water from known exit gas temperature.

EXAMPLE.—

Moisture in coal, as received	... ...	= 10 per cent.
$\frac{\text{S.C.F. calories as received}}{7{,}000}$	... ...	= 0.85 ,,
Standard coal consumption	... ...	= 27.0 ,,
Water per 100 lbs. clinker	... ...	$= \frac{10 \text{ per cent.} \times 27}{0.85} = 3.18$ lbs.
Exit gas temperature	... ...	= 700 deg. F.
Heat in water in coal moisture	... ...	= 1,351 B.Th.U. × 3.18 lbs. = 4,296 B.Th.U. per 100 lbs. clinker ...... (6)

(7) **Heat in CO in Exit Gases.**—Determine the B.Th.U. per lb. of clinker from the known percentage of standard coal and the known CO_2+CO by gas analysis from the table. Multiply by the percentage of CO from gas analysis and by 100 for B.Th.U. per 100 lbs. clinker.

EXAMPLE.—

$CO_2=25.7$ per cent. $CO=0.2$ per cent. $CO+CO_2=25.9$.
Standard coal = 27 per cent.
B.Th.U. per lb. of clinker per 1 per cent. of CO = 145.36.
B.Th.U. per lb. of clinker = 145.36 × 0.2 CO.
= 29.07 B.Th.U.
= 2,907 B.Th.U. per 100 lbs. clinker .... (7)

(8) **Heat in Clinker Leaving Cooler.**—Determine B.Th.U. per lb. of clinker at known temperature of clinker leaving cooler and multiply by 100 for B.Th.U. per 100 lbs. clinker.

EXAMPLE.—

Temperature of clinker leaving cooler ...		= 300 deg. F.
B.Th.U. per lb. of clinker ...	... ...	= 47 B.Th.U.
B.Th.U. per 100 lbs. clinker	... ...	= 4,700 ,, ... (8)

(9 **Heat in Air Moisture and Dust Losses.**

An allowance should be made of 4 B.Th.U. for every 1 deg. F. in the temperature of the gases above 60 deg. F.

EXAMPLE.—

Exit gas temperature—700 deg. F. − 60 deg. F. = 640 deg. F.
Heat in air moisture, dust losses, etc. =
640 × 4 = 2,560 B.Th.U. per 100 lbs. clinker .... (9)

CREDIT ITEMS.

(10) **Heat in Calorific Value of Coal.**

Multiply by percentage of standard coal.
Standard coal, 27 per cent.
Calorific value, $12,600 \times 27 = 340,200$ B.Th.U. .... (10)

(11) **Exothermic Reaction.**—Obtain the percentage of lime in clinker from known percentage of $CaCO_3$ in slurry. Multiply by 269.6 for B.Th.U. per 100 lbs. clinker from exothermic reaction.

EXAMPLE.—

$CaCO_3 = 76.5$. $CaO = 66.5$.
B.Th.U. from exothermic reaction per 100 lbs. clinker
$= 66.5 \times 269.6$.
$= 17,880$ B.Th.U. per 100 lbs. clinker .... (11)

(12) **Heat in Organic Matter in Raw Material.**—Assuming this to be peat, the calorific value will be approximately 5,000 B.Th.U. per lb. of organic matter.
for 100 lbs. clinker—7,930 × percentage of organic matter in slurry = B.Th.U. per 100 lbs. clinker.

EXAMPLE.—

Percentage of organic matter in slurry = 1.
$= 7,930$ B.Th.U. per 100 lbs. clinker .... (12)

SUMMARY.

These twelve items are now collected and totalled in the form of a heat balance from which the heat lost by radiation and convection or otherwise is shown as a balance of heat unaccounted for. The divisor for converting British Thermal Units into percentage of standard coal is 12,600.

DEBITS.— **Heat Balance.**

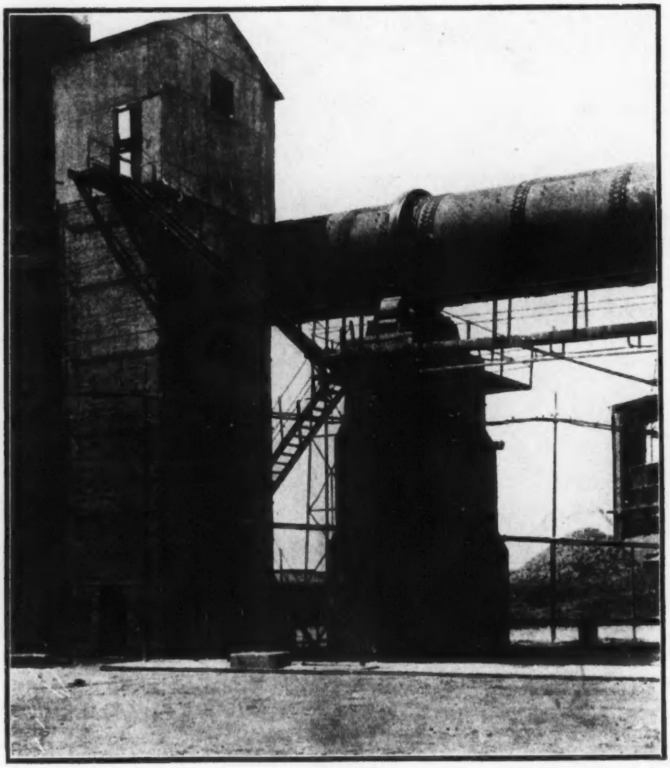
HEAT EXPELLED IN CHIMNEY GASES FROM—	B.Th.U.	Percentage of Standard Coal.
CO_2 *ex* raw materials	8,366	0.664
H_2O ,, ,, ...	144,692	11.480
Combustion gases	57,861	4.592
Excess air	3,580	0.284
H_2O in coal moisture	4,296	0.341
CO from incomplete combustion ...	2,907	0.231
From dust and air moisture	2,560	0.203
Heat required in dissociation of carbonate	91,120	7.232
Heat lost in clinker from cooler ...	4,700	0.373
Total heat accounted for	320,082	25.400
Balance—not accounted for ...	45,928	3.648
Total	366,010	29.048
CREDITS.—		
Coal calorific value	340,200	27.0
Exothermic reaction	17,880	1.419
Organic matter in slurry	7,930	.629
Total	366,010	29.048

The Japla Works of the Sone Valley Portland Cement Co., Ltd.

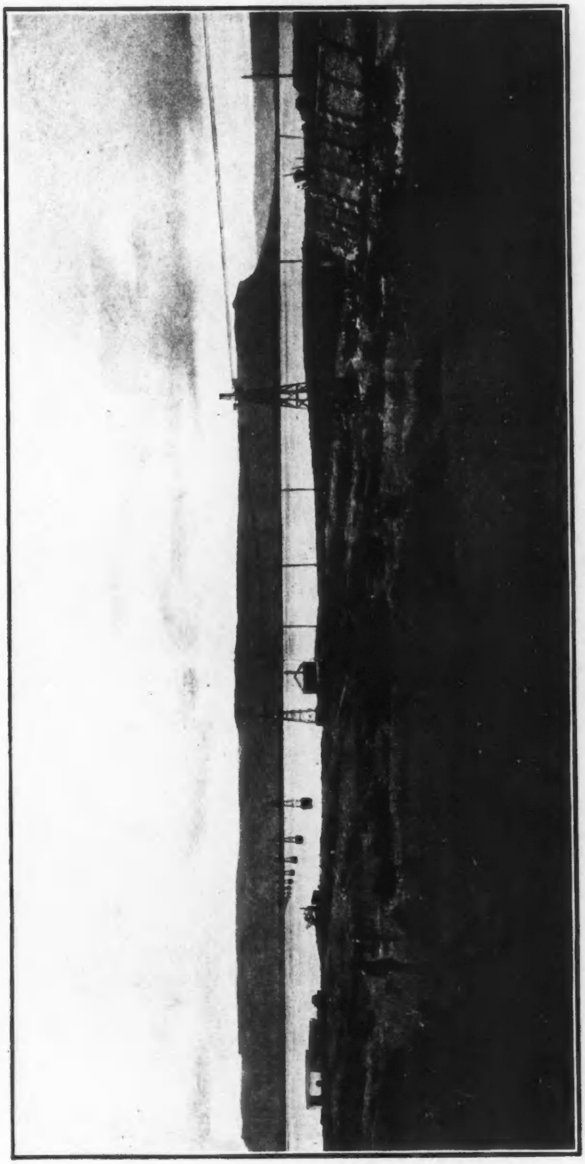
THE works of this Company are situated on the banks of the Sone river in the province of Bihar, India, approximately 400 miles from Calcutta, its nearest commercial centre. There are no other industries within many miles of Japla.

The proposal to start a cement factory at Japla originated with the Associated Portland Cement Manufacturers, Ltd., of London, who after a thorough investigation decided to model the works on the lines of their most up-to-date factories at that time (1920). To this end they co-operated with Messrs. Martin & Co., who have since acted as managing agents of the Company.

Several difficulties had to be contended with. The East Indian Railway, from Daltonganj to Sone East Bank (the nearest station situated on the main



The Kiln.



The Aerial Ropeway at Japla Works.

East Indian Railway) runs to the east of the river Sone, a river three miles wide at this point, whereas the limestone deposits are situated in the Kymore hills on the west bank of the river. On the west side there is no railway within a hundred miles, and consequently it was necessary to construct the works on the east bank and bring the limestone across the river by means of an aerial ropeway. This ropeway is five miles long. The Sone river is extremely turbulent in the monsoon period, and in 1923 rose to such a high level that part of the ropeway was washed away. Since 1923 the ropeway piers have been considerably strengthened, and no further accident has occurred. At present it carries over 400 tons of limestone daily.

The works were designed for an output of 1,000 tons of cement per week, but since its construction various local improvements have been effected, and during the last two years an average of 1,500 tons of cement per week has been produced.

The limestone is won from the quarry by a pneumatic drill and blasting, the compressed air being obtained from petrol-engine-driven compressors. No crushing is done in the quarry, and the stone is carried by aerial ropeway to the works, where it is tipped into the crushing plant hoppers or to the stock heap. As the limestone averages less than 80 per cent. of carbonate of lime only a very small proportion of shale is needed to produce the correct cement mixture. The raw-material preparation plant consists of jaw crushers and a ball mill and two tubemills. Owing to the nature of the limestone it is possible to make slurry with 34 per cent. of moisture. There are four sun-and-planet mixers, equivalent to 1,000 tons of clinker. The rotary kiln is 200 ft. long and 9 ft. diameter, with a burning zone of 10 ft. Coal is ground in a compound tubemill, and when necessary is dried in a cylindrical drum of the usual type. Clinker is ground in a ball-mill and two tubemills. The power plant consists of three Babcock & Wilcox water-tube boilers with chain-grate stokers and two turbo-alternators of 1,250 and 500 KW respectively, the current being 3-phase, 50-cycle and 500-volts. All the manufacturing units are electrically driven. Simplicity of plant has been the keynote of the design for a works almost entirely in the hands of native labour, and several hundred miles from large engineering shops.

The factory employs over 800 people, mainly recruited from Bihar and Orissa, Bengal, Central Provinces, and in a few isolated cases from the Punjab. The quarry labour force fluctuates considerably during the year owing to agricultural requirements, but the average is about 1,000. The harmonious working of such a varied labour force reflects great credit on the four experts especially sent out from England and assisted by about forty Indian assistants. The staff, although leading a strenuous and solitary life, particularly during the very hot season and monotonous monsoons, have tennis and Badminton courts, swimming pools, football grounds, and a club house with full equipment for theatrical and cinematograph performances. The management provide free quarters for all staff and labour, including filtered water (a great necessity in tropical climates), electric light, and fuel. Fully-equipped hospitals are main-

tained both at the works and in the quarry, and medical attendance is provided free to all members of the staff and workmen.

Messrs. Gillanders, Arbuthnot & Co., one of the oldest mercantile firms in East India, act with Messrs. Martin & Co. as joint selling agents of the Company's " Rohtas " cement. These two companies have during recent years sold the Factory's maximum output so successfully that further extensions of the works are now contemplated.

Proposed Australian Combination.

" Australian Cement Company, Pty., Ltd.," is the title of a new holding company formed with a capital of five million pounds, registered in Victoria, to take over the assets of the Kandos and Australian Cement Companies. The manufacturing capacity of the combined works will be 400,000 tons per annum. Orders received by the new company will be despatched either from the New South Wales or from the Victoria Works according to geographical position. We also understand that the David Mitchel Estate, the only other operating works in Victoria, has made arrangements to obtain all its supplies from the new Australian Cement Company, amounting to approximately 12,000 tons per annum, and will close down its own plant. We are also advised that the National Portland Cement Company, which was proposing to close down its Tasmanian works and erect a plant in Victoria, is proposing to join the new concern.

Kandos Cement Company.

For the financial year ended June 30th last this Company shows a net profit of £137,898, which is £16,248 less than the preceding year. The directors consider the results satisfactory, and state that trading has been well maintained. The customary 10 per cent. dividend is being paid.

Queensland Cement and Lime Co., Ltd.

For the year ended July 31 this Company shows a net income of £45,882, compared with £37,385 for the preceding year, and a dividend is again declared of 6 per cent. plus a bonus of 2 per cent. on the ordinary shares. The directors report that although there was a trade depreciation during the period under review, sales were well maintained.

Paper Bags in Denmark.

Messrs. F. L. Smidth & Co. are reported to have established a subsidiary company with a capital of 100,000 Kr. (£5,490) under the name of Bates Ventil Säkke Kompani. It is proposed to establish a factory at Aalborg for the manufacture of paper sacks in accordance with the American Bates' Co.'s patents.

Portland Cement in Argentina.

ACCORDING to statistics compiled by " Revista de Economia Argentina," the use of Portland cement is steadily increasing in that country. The yearly consumption is at present 658,491 tons, of which only about one-third part is produced in the Republic.

The yearly increase in the consumption of cement during the last decade is shown in the following table: —

YEAR.	TONS.
1919	130,040
1920	204,059
1921	229,215
1922	263,884
1923	318,120
1924	412,743
1925	442 936
1926	525,027
1927	592,476
1928	658,491

There were five cement factories operating in the Republic last year (1928), producing 233,291 tons against a total output of only 38,740 tons in 1919. The producing capacity of these five cement works is 334,200 tons yearly, and with a large new factory to be installed in Cordoba the yearly production will exceed 450,000 tons.

There also has been a constant increase in the importation of Portland cement during the last decade, the quantity having increased from 53,459 tons in 1918 to 457,647 tons in 1928.

The importations of Portland cement from England during the first five months of 1928 and 1929 respectively were: 1928, 16,372 tons; 1929, 35,776 tons.

Currency has been given recently in Buenos Aires to a report that Lord d'Abernon had agreed with President Trigoyen whereby Great Britain would lend Argentina a sum of $200,000,000 to be expended on a vast scheme of road construction throughout the Republic, but there appears to be no foundation for the rumour. The Government organ " La Epoca " states: " No such loan has been contracted, nor is any such loan being negotiated. The only treaty arranged with the British Government is that of one hundred millions of pesos for reciprocal purchases of which the text has already been published."

New Company Registered.

NORTHERN RHODESIAN CEMENT CORPORATION, LTD. (241,872). Registered August 22nd, 1929. 845/850, Salisbury House, E.C.2. Nominal capital, £100. Subscribers: R. A. Malkin, 166, Forest Hill Road, S.E.23; Agnes M. Magner, 38, Parkhill Road, N.W.3.

Effect of Fuel and Air Mixture in Burning Clinker.

IN a recent number of Rock Products, Mr. H. H. Biaise, chief chemist of the Giant Portland Cement Co., U.S.A., states that there has been much conjecture as to the proper methods of using a rotary kiln. The effects of load, speed, character of flame, draughts, hood pressure, preheated air, insulation, and the many other variables have been discussed often and without any discernible standard being established. A trip through a dozen Portland cement plants in different parts of the United States will reveal as many systems of burning. It seems that every works manager, engineer and chemist has his own ideas upon the subject, and will maintain his position come what may. One man will insist that only a long flame with plenty of draught will do the work; another supports a short hot flame. Still another adheres to certain ratios of primary air and secondary air, limiting the maximum actually mixed with the fuel to 35 per cent.; while another holds the opinion that the only correct method of producing clinker is by the system of pre-mixing the greater portion of air required for combustion before entry into the kiln.

It is while using the last-named system, that is the system by which the larger proportion of the air required for complete combustion is mixed with the fuel before injecting it into the kiln, that the experiments outlined here were based. The reason for this is that a slighter variation in mixing conditions in the burner is required for the production of variable results than is found when dependence is placed upon infiltration around the kiln hood to supply air needed in a 60 per cent. or 70 per cent. deficiency. It was subsequently proved that any type of burner could be made to produce these results under certain conditions. The writer does not consider these tests complete but they afford a check for other observers or possibly a basis for further experimental work.

It had been first noted that some kilns produced clinkers that were hard and black on the exterior, and, although well burned throughout, possessed brown centres which were as hard as the exterior. It was further noted that these clinkers when quenched with water assumed a dirty yellow colour. These clinkers sometimes showed slight evidence of disintegration. Second, it was noted that other kilns burning mixtures containing exactly the same chemical balance as those mentioned in the first instance were quite black all through and apparently possessed the same degree of hardness. The clinkers generally retained their original colour when quenched with water. There was a marked difference in the colour of the two cements produced from these clinkers. The first had a distinct yellow tinge, while the second had a blue-gray colour.

Causes of Different Coloured Clinker.

In order to determine the cause of this, a sample of the clinkers containing the brown centres was obtained. This was divided into three parts, A, B, and C. Sample A was crushed and without further treatment was consigned to a laboratory ball-mill and ground for twelve minutes. The cement produced by

this grinding had a yellow colour. Sample B was crushed and heated for one hour in a muffle electric furnace at a temperature of 1,800 deg. F. After being cooled this sample was ground for twelve minutes in the ball-mill. The cement produced from this sample was blue-gray. Sample C was then crushed and placed in a crucible. It was then sealed from the air by a layer of cement and charcoal. It was also heated for one hour, cooled, and ground for twelve minutes. The yellow colour was very evident in this sample. In Sample B the yellow colour had disappeared during the heating while exposed to air. A summary of the physical tests made on the cement produced from these samples subsequent to the addition of sufficient calcium sulphate to bring the percentage of sulphur trioxide in each to 1.50, is shown in Table I foot of the page.

Sample B had certain definite physical characteristics which differed from those in Samples A and C. It was reasonable to believe that the total time required for setting was less by about 15 per cent. It was possible that this condition had been brought about by the greater fineness of Sample B. But since they had been ground under conditions as near similar as it was possible to make them, then the only deduction possible was that Sample B was easier to grind, in spite of the fact that all three samples had been extracted from the kiln in one portion. In the laboratory the only difference in treatment lay in the fact that air that had been allowed to come in contact with the sample had a high temperature, but a temperature insufficient to fuse the clinker or change its physical characteristics to any normal degree.

TABLE I.

SUMMARY OF THE PHYSICAL TESTS ON CLINKER SAMPLES.

	Sample A	Sample B	Sample C
Initial set	3 hr.	3 hr. 30 min.	3 hr. 45 min.
Final set	6 hr. 10 min.	5 hr. 30 min.	6 hr. 45 min.
Fineness 200-mesh after 12 min. grinding	84.12	87.12	83.40
Tensile strength, lb. per sq. in., 1 part cement to 3 parts sand:			
At 1 day	86	97	80
At 3 days	188	202	172
At 7 days	270	275	245
At 28 days	395	407	367
Soundness	O.K.	O.K.	O.K.

It was therefore assumed without any further basis except to furnish a hypothetical starting point, that this brown colour was due to the lack of oxygen in the kiln at some point. We could offer no further explanation for the fact that the clinkers were black on the outside except that this was caused by a belated oxidised condition under circumstances which did not permit penetration of the mass beyond a depth of 1/64 of an inch.

Experiments under Operating Conditions.

A kiln was then selected which was producing clinkers of the brown-centre type, and it was decided to adjust the air supply on this kiln until a flame possessing strictly oxidising properties was obtained, without regard for the efficiency of combustion further than the production of well-burned clinker. In order to eliminate all possible chances of contamination of clinker by fuel or fuel ash, natural gas was used for burning in a kiln 11 ft. 3 in. in diameter by 240 ft. in length. The following starting conditions were recorded:

TEST No. 1.

Kiln speed—1 r.p.m.
Feed rate—72 bbl. per hour.
Temperature of air in burner pipe—300 deg. F.
Air volume—20,350 cu. ft. per minute.
Gas volume—1,883 cu. ft. per minute at 60 deg. F.
Percentage of total air required for combustion put through burner pipe—81.6.
Velocity at burner tip—6,500 ft. per minute.
Chimney temperature—1,100 deg. F.
Fuel efficiency—1,570 cu. ft. of gas per bbl. of clinker.
Products of combustion—Carbon dioxide, 21 per cent.; oxygen, 0.75 per cent.; carbon monoxide, 0.0 per cent.
Amount of air revealed by chimney gas as in relation to amount required—103.8 per cent.
Colour of clinker—Fine black sparkling exterior with hard brown centres.

Here was a puzzle. We had a preponderance of air over that required to burn efficiently all fuel with an oxidising flame, but still we had a colour condition that we had agreed to attribute to a reducing condition. We were then either wrong in our hypotheses, or the air and fuel were improperly mixed. Accordingly we attempted without regard for fuel efficiency to drive the amount of air to such proportions that everywhere in the kiln would there be a preponderance of oxygen. This we accomplished under the following conditions:

TEST No. 2.

Kiln speed—1 r.p.m.
Air temperature in burner—394 deg. F.
Air volume in burner—23,991 cu. ft. per minute.
Gas volume in burner—1,800 cu. ft. per minute at 60 deg. F.
Portion of air required for combustion put through burner—79.6.
Velocity of air supply—6,900 ft. per minute.
Chimney temperature—1,100 deg. F.
Products of combustion—Carbon dioxide, 16 per cent.; oxygen, 4 per cent.; carbon monoxide, 1 per cent.
Percentage of air necessary for complete combustion as revealed by chimney gas—118.9 per cent.
Colour of clinker—Black throughout, excellent texture, did not turn yellow when quenched with water.

Further tests showed this clinker to be easier to grind. However, the firing conditions of this test were wasteful to the extreme, and steps were taken to correct this. It was evident that the necessity for such a preponderance of air over the amount actually required for combustion must be due to poor mixing of the fuel and its air supply. Evidently there existed zones in the kiln that possessed a large surplus of air, and vice versa. Thereupon cross-sectional analyses were made on the burner pipe at a point after the air had been introduced into the mixing chamber. A stratified condition was found in the burner with at least 80 per cent. of all the gas flowing in the upper one-third of the burner pipe, while there was none in the bottom half. This explained the conditions noted in the clinker formation. Clearly the heavily-laden gas-stream flowing along the top had been projected farther into the kiln. This in striking the clinker at the point of fusion carried on the work under reducing conditions. It is probable that all clinker at this point was of a yellow colour inside and out, though thoroughly burned. Later, as it progressed down the kiln, it came in contact with that portion of the burner stream carrying a surplus of oxygen, and the result was a coat of oxidised clinker on the outside.

Following this discovery a move was made to mix the fuel thoroughly in the burner to ascertain whether it was possible to produce the complete oxidation of clinker under more efficient conditions. The first step taken in this direction was more successful, and the result is given in the following test, although in successive steps the condition was remedied until it was possible to produce the result wanted with exactly the correct amount of air necessary for complete combustion:

TEST No. 3.

Kiln speed—1 r.p.m.
Air temperature in burner—430 deg. F.
Air volume in burner—21,860 cu. ft. per minute.
Total air by stack gas analyses—34,600 cu. ft. per minute.
Gas volume—1,917 cu. ft. per minute at 60 deg. F.
Feed rate—78 bbl. per hour.
Percentage of required air put through burner—70.25.
Fuel efficiency—1,470 cu. ft. of gas per bbl. of clinker.
Products of combustion—Carbon dioxide, 21 per cent.; oxygen, 2 per cent.; carbon monoxide, 0.0 per cent.
Total air as revealed by chimney gases in relation to total air required—111.5 per cent.
Colour of clinker—The clinker produced by this test was black throughout and of finest quality.

It was also found that this clinker could be turned brown or black at will by manipulation of the air supply. Following are some tests taken upon both types of clinkers under actual operating conditions:

Tensile strength, 1 cement 3 standard sand per sq. in. Test covers approxi-

mately 100,000 bbl. of cement in each case, ground from 81 per cent. to 83 per cent. through 200-mesh.

Cement made with reducing flame:

At 7 days	241 lb. per sq. in.
At 28 days	355 ,, ,,
At 90 days	358 ,, ,,

Cement made by oxidising flame:

At 7 days	325 lb. per sq. in.
At 28 days	453 ,, ,,
At 90 days	495 ,, ,,

Further to check these findings, tests were made using oil and coal for fuel. It was found that all the conditions made herein could be reproduced making due allowance for ash contamination. The cement used in these tests carried a high iron content of about 4.5 per cent., and it is agreed that these things might be more easily noted in a cement of this character than in one somewhat lower in iron. No effort was made by laboratory methods to determine the exact state of the iron in the two clinkers. It was satisfactorily demonstrated that the amount of air and the method of mixing this air with the fuel did have a marked effect on the resulting material regardless of the degree of burning.

Summing up, it would seem that an improvement in colour, strength and grindability is accomplished by the use of a flame oxidising in character. By this is meant that the flame must be evenly oxidising throughout all burning points in the kiln. To have a good chimney gas analysis is by no means proof that an oxidising condition exists in the kiln.

Cement Sales in Germany.

German cement sales in the first nine months of the current year, at 5,600,000 tons, show a falling off as against the same period last year, in which cement consignments amounted to 6,000,000 tons.

The development in sales this year is as follows:—

	1929.	1928.
1st quarter	686,000 tons	1,499,000 tons
2nd ,, ...	2,501,000 ,,	2,198,000 ,,
3rd ,, ...	2,404,000 ,,	2,319,000 ,,
	5,591,000 tons	6,016,000 tons
October	677,000 ,,	681,000 ,,

Cement Plant for Hong Kong.

The Green Island Cement Company has placed a contract with Vickers-Armstrong, Ltd., for a cement plant capable of an annual output of 100,000 tons.

Quarrying Equipment at Maastricht.

Electrically-driven Shovel with $4\frac{1}{2}$ cu. yd. Bucket.

Electrically-driven Grab Excavator with Grab of $2\frac{3}{4}$ cu. yd. capacity and 83-ft. Jib.

The cement works at Maastricht was described in our number for April, 1929. The photographs above show two views in the quarry; the excavator in the top illustration is used to remove overburden, which in parts is 56 ft. thick. In the photo the excavator is seen digging hard gravel 33ft. below level and filling into trucks 20 ft. above level.

Notes from Abroad.

Cement Consumption in Austria.

The production and consumption of cement in Austria during the years 1925 to 1928 was as follows (in tons):

	1925.	1926.	1927.	1928.
Production ...	420,000	430,000	480,000	520,000
Imports ...	8,784	16,744	22,781	20,732
Exports ...	25,237	21,001	8,423	10,000
Consumption ...	403,547	425,743	494,358	530,732

Austria's manufacturing capacity during 1928 is estimated to be just under 1,000,000 tons.

Notes from Belgium.

Ciments Portland Liegeois is doubling its capital of 4,650,000 frs. (£26,570).

S. A. Ciments de Cronfestu is increasing its capital from 7,200,000 Frs. to 10,800,000 Frs. (£71,700).

According to a report by the American Consul at Antwerp, activity in the cement industry continued throughout the month of August, and both domestic and export demands were strong. Despite the fact that all mills were operated to maximum capacity, the demand exceeded production and orders have been booked for late delivery. Manufacturers are complaining of the reduced margin of profit resulting from keen competition. It is stated that while the selling price is being kept down the cost of production is continually increasing, labour is becoming scarcer, and wages are increasing.

French Sales, January to June, 1929.

The sales of cement in France for the first half of the year 1929 show an increase of 10 per cent. over the same period for the past year. The demand continues strong during the second half of the present year.

Amalgamation in Hungary.

Felsögallai Cementgvar (Totis), one of the chief cement manufacturers in Hungary, has absorbed another company, the Nyergesujfalus plant, which has an annual capacity of 30,000 tons.

Cement Congress in Finland.

The Finnish Cement Association recently received representatives of the Swedish and Norwegian Cement Associations at a congress held at Helsingfors, where questions regarding cement manufacture were dealt with.

Combine in the German Cement Industry.

It is reported that an important agreement has been reached between Schlesische Portland Cement Industry, the Dyckerhoff Company, the E. Schweck Cement Company, and the Heidelberg, Mannheim & Stuttgart Co. The German newspapers suggest that this agreement is probably a precautionary measure against the disintegration of the German Zement-Bund.

Norwegian and Danish Exports.

Negotiations have taken place between Norwegian and Danish cement manufacturers for the purpose of creating an export syndicate with a view to developing the export side of their respective industries. It is reported that development in Asia is particularly desired.

Notes from the Philippine Islands.

The present contract between the Philippine Government and the Cebu Portland Cement Company expires this year, and negotiations are now under way for a further five-year contract. The current price is 4.75 peso per barrel (9s. 6d.), and the Cebu Cement Company are asking 4.90 peso (9s. 9½d.) per barrel for the new contract. The Government expects to use not less than 200,000 barrels during 1930.

The Madrigal Cement Co. has purchased the Rizal Cement Company's plant, and it is hoped that manufacture will take place shortly. The capacity of the plant is stated to be a thousand barrels a day. It is anticipated that the cement plant will shortly be electrified.

Imports of cement into the Philippines last year amounted to 54,700 tons.

Russian Developments.

In accordance with the Soviet Government's five-year program of re-organisation in the cement industry, an American firm has concluded an agreement with the Government and are forming a Russian-American company with a capital of three million roubles, which will undertake the erection of the four cement plants in question at a cost of £315,000.

Amalgamations in Poland.

The following Polish cement plants have amalgamated their interests: Goleszowska Fabryka Portland Cement Tow. Ack., Sp. Ack. Fabryki Portland Cementu "Szczakowa," Zement Fabrik "Wolyn," Towarzystwo Fabriki Portland Cementu "Wysoka."

Cape Portland Cement Company.

For the past financial year this Company showed a net profit of £55,664, and has declared a total dividend of 12½ per cent. The directors report that sales during the year have been satisfactory. This Company is a subsidiary of the Pretoria Portland Cement Company.

New Plant for Spain.

The Asland Company is erecting a new factory at Cordoba with a capacity of 70,000 tons per annum. The plant will be operated under the name of Asland-Cordoba Sociedad Anonima.

New Turkish Company.

A cement company named Cemento ve Kireci anonim Sirketi has been founded with a nominal capital of Turkish L.1,500,000 (£160,000).

Capital Increase in France.

Societe Financière des Ciments et de l'Industrie are increasing their capital from 50 to 100 million francs (£800,000).

Recent Patents Relating to Cement.

Filling and Closing Bags. WHITE, A. E., 88, Chancery Lane, London. (Bates Valve Bag Corporation, 8200, South Chicago Avenue, Chicago, U.S.A.) No. 13853.

Each bag is supported by its mouth during the filling operation in one of a series of carriages (22) mounted on wheels (27) running on a track (10). Each carriage comprises a rectangular frame (26) provided with a central opening (28) over which a fixed bag clamp (29) and a movable clamp (30) are arranged to operate. The movable clamp is carried on a plate (31) secured to the frame at one end by a link (32) and at the other by a lever (35) actuated by a hand-lever (38). The mouth of the bag is gripped between swinging jaws (69) and arms (46), the latter projecting from rock shafts (45) mounted in series of brackets (44). Spring-cushioned bolts (48) passing through openings in the frame (26) and in lugs (47) projecting downwardly from the arms (46) limit the movement of the arms. Each arm is provided with a socket (52), and on each side a clamping beam (53) having a flattened side (54) is mounted in these sockets. A second rock shaft (57) is mounted on each side of the clamp in the brackets (44). Claws (58) carrying the jaw (69) are pivoted on this shaft, and are forced forward by springs (61) positioned on loose bolts between the claws and arms (59) projecting from the rock shaft. Each shaft (57) may be rocked by a hand lever (62) attached to a rack (63) meshing with a pinion (66) on the shaft. A spring actuated ball locks the rack in the position to which it has been moved by the hand lever. The mouth of a bag is inserted in a carriage while the movable clamping member is away from the fixed clamping member, the sides of the bag being spread over the clamping beams and then the jaws (69) being brought down to engage and hold the bag by moving the hand levers (62). The carriage is then brought beneath a filling hopper (11), the track (10) being arranged, if desired, with an incline. The bag may be suspended freely or may, if desired, be provided with a bottom support. After filling, the carriage is moved along the track until a lug (21) on the frame is engaged by one of a series of projections (20) on a conveyor (19), by which it is carried under a sewing head (12), the lever (38) being operated to swing the movable clamp towards the stationary clamp and the hand

FIG.1.

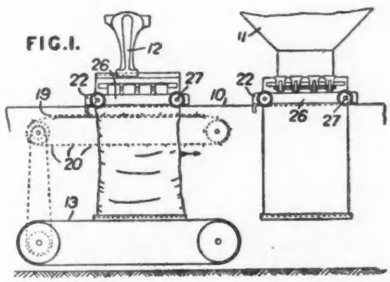


FIG.2.

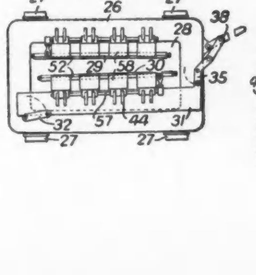
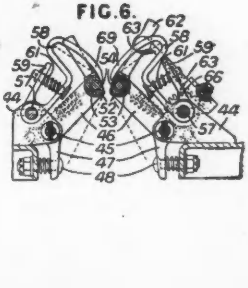


FIG.6.



levers (62) operated to lift the jaws (69) so that the mouth of the bag is closed and the edges held together between the beams. The bottom of the bag is supported by a conveyor (13). The bag is then closed by a reinforced seam and delivered. The carriage (22) may be returned to the entrance end of the track by a loop or return track.

Cements. SOC. ANON. DES CHAUX ET CIMENTS DE LAFARGE ET DU TEIL, Viviers, Ardèche, France. July 29, 1929, No. 23,294.

A hydraulic binding medium consists of an intimate mixture of aluminous cement prepared by melting, clinkerizing, or fritting, and calcium sulphate in any form, such as gypsum, anhydrite, or more or less burnt plaster. The proportions are preferably such that all the alumina is converted into calcium sulpho-aluminate, and the mixture usually contains from 20 to 50 per cent. of calcium sulphate. Other proportions of from 5 to 95 per cent. of either ingredient may, however, also be used. The calcium sulphate may be added to the raw material of the aluminous cement, the mixture being then heated without melting. The fineness of the sulphate may vary from coarse to exceedingly fine.

Cements: Plastic and Coating Compositions. KOLLOIDCHEMIE STUDIENGES, 103, Danielstrasse, Hamburg, CARPZOW, J. B., Geesthachter Chaussee, Börnsen, near Hamburg, MARCH, M., 85, Leinpfad, LENZMANN, R., 63, Leinpfad, both in Hamburg, all in Germany, and SANDERS, H., 39, Holland Park Avenue, London. May 30, 1928, No. 15,819.

Cements, building, plastering and coating materials are formed by causing fresh mud containing unsaturated silicon compounds, or the colloidal constituents separated therefrom, to react, preferably in the absence of air, with finely divided metal oxides or other compounds other than chalk or lime. Bacterial nutrients and anaerobic bacteria cultures may be added to the mud to increase its activity. The mud or separated colloids, prior to being mixed with the other compounds, may be dried, preferably in the absence of air, at temperatures below 80° C. so as to maintain substantially the colloidal structure and unsaturated state. In examples (1) 100 parts of mud are mixed with 20 parts of aluminium sulphate, allowed to stand for 24 hours, dried and ground. The product may be mixed with cement and mortar for making slabs and as plastering and coating material. (2) 100 parts of mud are mixed with 10 parts of an oxide of chromium, cobalt or titanium, are dried after 24 hours, calcined at 800° C., and powdered. The product can be used for colouring lime sandstone. (3) A cement is formed by mixing 100 parts of mud, 20 parts of powdered bauxite and 10 parts of barium sulphate, storing for some time in absence of air, air drying, calcining at 800° C., and grinding. (4) 100 parts of mud, 20 parts of kaolin, and 20 parts of furnace slag are mixed, air dried and pulverized. The powder is mixed with an aqueous solution of alkaline silicates or of fluoric compounds for use as a liquid cement or as a mouldable composition. Examples are also given in which magnesium, iron and calcium sulphates, magnesium chloride, pyrolusite, talc and ferric oxide are combined with the mud.

Cements. IMAI, G., 627, Hatsudai, Yoyogi, Yoyohata-Machi, Toyotama-Gun, Tokio. February 15, 1929, No. 5120.

A mixture of calcined rock containing quartz and felspar, and a substance containing large proportions of acidic components such as soluble silica, alumina, and iron oxide, is mixed with Portland cement clinker and the whole is intimately mixed and finely ground. Suitable rocks are granite, liparite, quartz porphyrite, and diorite, and suitable substances for the second ingredient are weathered tuff, basalt and andesite and artificial substances such as slag. In an example from 3 to 5 parts of the first ingredient are mixed with from 5 to 3 parts of the second; the mixture is ground at a temperature of about 150 to 200 deg. C. and mixed with about 30 to 40 per cent. of Portland cement clinker; the whole is then re-ground.

Paper Bags. BATES INTERNATIONAL BAG Co., 48, Wall Street, New York, U.S.A. (Assignees of Hoppe, E.; 178, Kurfürstendamm, Berlin.) September 6, 1929, No. 27125.

In a single or multi-ply paper bag the borders of the two opposed flat sides of the bag tube are folded inwardly upon each other and secured by a pasting tape. At each corner of a length of three-ply bag tube (1) having pleated sides (3) and an extension (10) at one corner, a valve is formed

in the usual manner, the one having the tab or extension (10) becoming a filling valve; the corners are thereby turned inwards as at (11, 12, 14, 15), the corners (11, 14 and 15) being similar to each other and the filling valve corner (12) slightly different. The end of the tube, say that comprising the corners (11, 12) is opened out to the position shown in Fig. 4^a, the side flaps are the corners are opened out, they appear as in Fig. 5; the filling valve end comprises the tab (10) and cut tabs (36, 37) and the opposite end an uncut tab (11^a) and cut tabs (38, 39). The tabs (36, 37) are folded inwards on the tab (10), the side flaps (41, 42) are folded on the tabs (36, 37) and the uncut tab (11^a) and pasted thereon, a pasting tape being also placed

FIG.2.

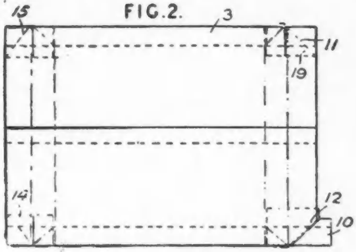


FIG.4^a

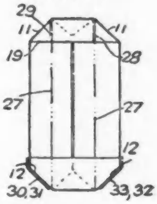


FIG 9.

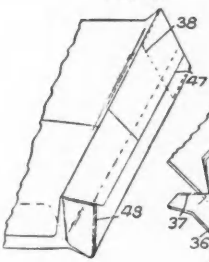


FIG.5.

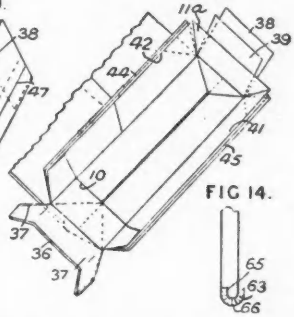


FIG 14.

folded inwards to crease them along the lines (27) and then re-opened preparatory to cuts (28 . . 33) being made in the top two plies of the tube. The cuts extend from the corner (11) along the creases (27) to the edge (19) of the folds of the corner; the cuts (30 . . 33) are in the inclined edge of the corner, the cuts (31, 33) being in the middle ply beneath the cuts (30, 32). When on the overlapping portions of the side flaps (41, 42). The end tab (39) and the next side flaps (44, 45), and finally the outside tab (38) and flaps (47, 48), Fig. 9, are similarly treated. The cuts (28, 29) may be omitted. In the case of a single-ply bag having no side pleats, the flaps (65, 66), Fig. 14, are turned inwards and secured by a pasting tape (66).

Recent Patent Applications.

No. 298,637. SOC. D'ETUDES CHIMIQUES POUR L'INDUSTRIE. — Purifying fused cements.

No. 316,715. H. J. BENHAM.—Manufacture of cement and lime.

No. 293,035. C. PONTOPPIDAN. Hydraulic cement.

No. 320,957. H. C. BADDER. Manufacture of cement.

Notes from the Foreign Press.

Abstracted by J. W. CHRISTELOW, B.Sc.

Conservation of Refractory Linings in Rotary Kilns. M. ELBER. *Rev. Matériaux de Construction*, p. 361, October, 1929.

The short life of kiln linings is a question of the greatest importance. The most serious causes of short life are: (1) direct impact of the flame on the lining due to irregular raw feed, coal feed or air supply; (2) stopping and re-starting the kiln. Attempts are made to lengthen the life of the lining by increasing the melting point of the refractory-bauxite or carborundum bricks; the latter would be generally used if their cost were not so high. Too little importance, however, is attached to the coefficient of thermal expansion of the refractory. Thus a clinkering zone lined with clinker brick (of low M.P) will often last longer than one lined with bauxite brick. Three layers of the lining must be considered: (1) the brick itself, (2) the clinker coating, and (3) a middle cementing layer of intermediate composition. Bauxite linings are of different expansion coefficients, and on heating or cooling have differential expansion or contraction, leading to disintegration. With clinker brick there is only one expansion coefficient throughout. Future research should aim at producing a refractory with a coefficient of expansion approximating to that of clinker.

Cement Grinding.

WE have received from the manufacturers the following notes on Helipebs grinding media :—

" Helipebs "—the name is an abbreviation of helical pebbles—are made of steel wire coiled in the form of a helix, and by a patent process afterwards hardened in a manner calculated to offer the greatest possible resistance to abrasion. Spherical grinders have only points of contact, and the area for abrasion is small. Helipebs do not roll upon one another when the mill is in rotation. The length of the Helipeb is determined by its diameter, and on the mill being set in motion the Helipebs align themselves with their longer axes at right angles to the axis of the mill, in which alignment they fall endways and slide one upon the other. Thus lines of contact are obtained, and the small gaps between the convolutions create a cutting or shearing action which serves to break down the larger grit. As each Helipeb is hollow it acts as an elevator and carries up a portion of the material being treated, which, when tipped out at the turn of the lift, is distributed between the grinding faces and thus facilitates reduction. The manufacturers are Messrs. Helipebs, Ltd., of Gloucester.

Average Earnings in Principal Industries.

THE " Ministry of Labour Gazette " for October contains an article giving the result of an inquiry by the Ministry on the average earnings of workpeople in five large groups of industries, viz. textile; clothing; pottery, brick, glass and chemicals; food, drink and tobacco; and paper, printing, etc. Comparison is made between the earnings for October, 1924, and October, 1928, and in the great majority of the industries the average earnings show only slight changes between the two dates. It is of particular interest to learn that the average earnings of all workers in the cement industry (61s. 5d. per week) are the highest amongst the manufacturing industries listed, and only exceeded amongst the non-manufacturing industries by newspaper printing and sugar refining.

The relative levels of average earnings per head in the different industries are affected by variations in the proportions of males and females, adults and juveniles, employed, and an endeavour has been made to show separately the numbers and earnings of male and female workers respectively. The separate figures thus given show that in industries employing many women the average earnings of the males only are substantially higher, as would be expected, but no table is given corrected in respect to the number of juveniles employed. Therefore the average earnings of the adult male workers only still cannot be exactly seen.

In the table for earnings of male workers (adult and juvenile) the figure for the cement industry is practically unchanged at 61s. 7d., as there are few women employed, but notwithstanding this it is still one of the industries with the highest average male earnings, and as there are many boys the average for the adult male only is no doubt still higher than that figure.

Cement Companies' Dividends.

Algeria.—Chaux et Ciments de Rivet-Alger is maintaining its dividend of 20 frs. for 1928. Net profits for the year: Frs. 1,173,402 (£9,387), against Frs. 1,193,608 (£9,550) for 1927.

Australia.—The Standard Portland Cement, Ltd. (New South Wales), for the financial year ending June, 1929, has declared its first dividend, namely, 8 per cent. Profits for the past three years are as follows: 1927, £4,949; 1928, £35,866; 1929, £47,268.

Adelaide Cement Co., Ltd., maintains its customary dividend of 15 per cent. for the year ending May 31st, 1929. Profits were reduced from £28,425 to £23,666.

Belgian Congo.—Ciments de Katanga shows an increased profit of Frs. 15,599,304 (£89,130) against the preceding year's profit of Frs. 10,166,443 (£58,100). The dividend is 210 frs. per share against 170 frs. in 1927.

Bulgaria.—La Fabrique Granitoid, the largest cement company in Bulgaria, is increasing its capital from 130 million to 180 million levas (£268,750). For the past financial year the company earned a net profit of 39,750,000 levas (£59,300) and distributed a dividend of 10 per cent.

Company Account.

Greaves, Bull & Lakin (Harbury Works), Ltd.—The second accounts of Greaves, Bull & Lakin (Harbury Works), Ltd., cement manufacturers, covering the year ended June 30, show a profit, after crediting £5,500 from income-tax reserve, being an amount no longer required, of £45,278 (against £75,533 for the preceding accounting period of 15 months). This is reduced by Debenture interest (£13,000) and a transfer to depreciation reserve (£12,000, against £20,000) to £20,278 (against a corresponding figure of £41,447 for the preceding period). A dividend of 8 per cent. is proposed (against 12½ per cent.), the "carry forward" being £6,550 (against £7,072). The trading profit was affected by the lower prices of cement ruling in the areas served by the company. The business of T. & J. Graham, which has been associated with the Greaves company as distributors, has been acquired, and a separate company formed to carry on the business, the whole of the capital of which is owned by the Greaves company, but no dividends from this source are included in the accounts. Allied Cement Manufacturers, Ltd., now control over 90 per cent. of the shareholding of the company.

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IMPORTS AND EXPORTS OF CALCAREOUS CEMENT FOR OCTOBER 1929 AND THE PERIOD JANUARY 1 TO OCTOBER 30, 1929.

Imports.

—	Quantities in Tons.						Value in £.					
	Month of October.			January 1 to October 30.			Month of October.			January 1 to October 30.		
	1927.	1928.	1929.	1927.	1928.	1929.	1927.	1928.	1929.	1927.	1928.	1929.
	30,423	15,717	26,404	362,130	239,357	242,413	60,017	33,603	45,271	751,666	458,374	443,437

Exports.

—	Quantities in Tons.						Value in £.					
	Month of October.			January 1 to October 30.			Month of October.			January 1 to October 30.		
	1927.	1928.	1929.	1927.	1928.	1929.	1927.	1928.	1929.	1927.	1928.	1929.
To Netherlands	305	2,803	3,413	776	10,428	23,869	562	4,012	6,748	1,805	16,246	43,934
,, Brazil	2,530	7,339	4,087	30,821	49,082	53,942	6,309	16,798	7,476	75,007	110,194	110,739
,, Argentine Republic ...	1,906	1,725	1,104	20,784	25,997	63,358	4,815	3,754	2,220	50,245	59,003	131,261
,, Irish Free State ...	9,228	10,765	13,828	91,030	106,098	119,049	27,345	32,660	39,912	292,507	328,252	348,939
,, British West Africa ...	8,973	6,521	10,053	80,283	100,943	73,380	21,533	15,922	24,674	204,194	255,079	181,581
,, ,, South Africa	151	577	557	4,587	3,721	3,804	537	2,156	1,699	13,341	12,589	11,620
,, ,, India... ...	9,419	12,398	8,753	95,328	84,454	80,590	24,519	33,677	22,411	251,779	219,675	209,510
,, Straits Settlements and Malay States	8,822	8,512	14,778	45,167	89,766	83,902	22,326	20,912	35,520	119,689	219,961	202,909
,, Australia	1,743	1,080	4,237	14,944	17,273	15,914	5,374	3,386	11,512	44,195	47,683	43,392
,, Other Countries ...	24,884	30,889	49,409	226,714	269,134	407,297	60,484	64,743	98,805	586,376	626,513	859,180
Total	67,961	82,609	110,225	610,434	756,896	925,105	173,804	198,020	250,977	1,639,138	1,895,195	2,143,065

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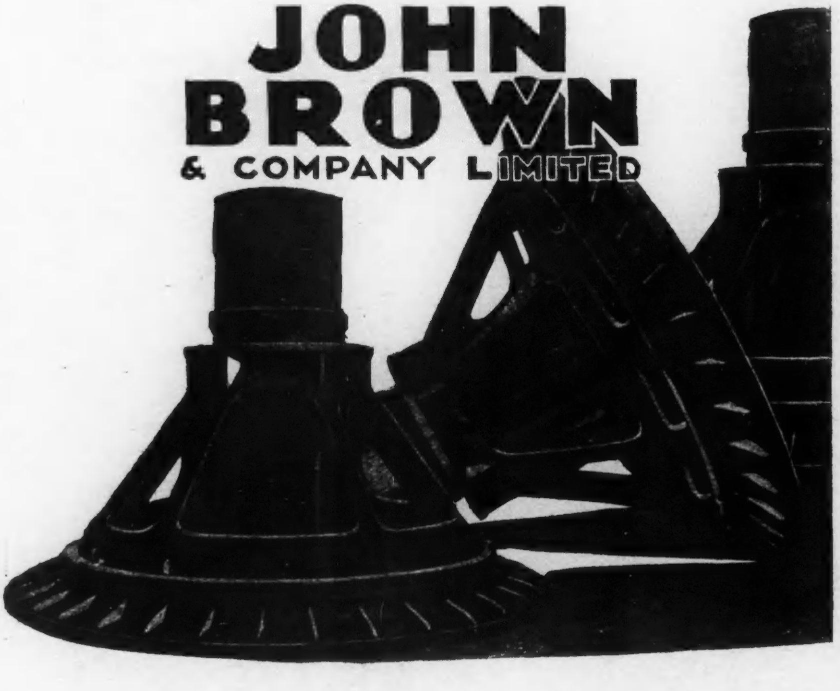

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